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'Developing animal behaviour and welfare: Real solutions for real problems'

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Monitoring activity on an individual level of group-housed pigs using computer vision

Sunday, 1st August - 18:00: Application of Technology to Applied Animal Behaviour and Welfare (2) - Oral

Thursday, 5th August - 09:45: Application of Technology to Applied Animal Behaviour and Welfare (2) - Oral

Thursday, 5th August - 10:45: Application of Technology to Applied Animal Behaviour and Welfare (2) - Oral

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Modern welfare definitions not only require that the Five Freedoms are met, but animals should also be able to adapt to changes (i.e. resilience) and reach a state that the animals experience as positive. Resilience is defined as the ability to cope with or quickly recover from a perturbation. Measuring resilience is challenging since relatively subtle changes in animal behaviour need to be observed 24/7, which would make human observation impossible. Changes in individual activity showed potential in previous studies to reflect resilience. A computer vision (CV) based tracking algorithm for pigs could potentially measure individual activity, which will be more objective and less time consuming than human observations. The aim of this study was to investigate the potential of state-of-the-art CV algorithms for pig detection and tracking for individual activity monitoring in pigs. Pigs were first detected using You Only Look Once v3 (YOLOv3) and were tracked using the Simple Online Real-time Tracking (SORT) algorithm. Two videos, of seven hours each, recorded in a barren and an enriched environment were used to test the tracking algorithm. Three detection models were proposed using different annotation datasets: a model with young pigs where annotated pigs were younger than in the test video, a model with older pigs where annotated pigs were older than the test video, and a combined model where annotations from younger and older pigs were combined. The combined detection model performed best with a mean average precision (mAP) of over 99.9% in the enriched environment and 99.7% in the barren environment. Intersection over Union (IOU) exceeded 85% in both environments, indicating a good accuracy of the detection algorithm. The tracking algorithm performed better in the enriched environment compared to the barren environment, likely due to the larger space per pig. When false-positive tracks where removed (i.e. tracks not associated with a pig), individual pigs were tracked on average for 22.3 minutes in the barren environment and 57.8 minutes in the enriched environment. The average track length varied between 7.1 and 138.3 minutes. Thus, based on tracking-by-detection algorithm using YOLOv3 and SORT, individual pigs can be tracked automatically in different environments, but manual corrections may be needed to keep track of the same individual throughout the video.